

PUNCTURED WOUNDS OF THE BLADDER.

REPORT OF A CASE, WITH A REVIEW OF THE LITERATURE.

BY EDWARD EVANS, M.D.,

OF LA CROSSE, WISCONSIN,

Surgeon to St. Francis's Hospital, La Crosse, Wisconsin,

AND

HARRY ATWOOD FOWLER, M.D.,

OF WASHINGTON, D. C.

WOUNDS of the urinary bladder are extremely uncommon. They are among the rarest surgical affections of that organ and are seldom observed in civil practice, except when produced by a surgeon's instrument. As Vidal said, "Il y a plus des plaies de la vessie faites par le chirurgien que des plaies dues à des accidents." The relative infrequency of wounds of the bladder is well shown by the following figures: Among 10,867 surgical patients treated at Bethany Hospital in eight years there were only three cases of bladder injury; there were only two such cases in 16,711 surgical patients admitted to St. Bartholomew's Hospital between 1869-75 (quoted from Bartels). In the 408,072 cases recorded in the War of the Rebellion, not a single case of punctured, incised, or lacerated wound of the bladder was reported, and there were only 183 cases of bullet wounds. These statistics serve to emphasize two points: (1) Wounds of the bladder are extremely uncommon. (2) They occur most frequently in the experience of military surgeons.

The following case from the service of Dr. Evans, of La Crosse, and reported before the Wisconsin State Medical Society in June, 1904, is of unusual interest, and forms the basis of this communication. On account of the relative infrequency of such accidents it has seemed to us that a brief summary

of the literature in connection with this case might not be without interest.

The history of the case is as follows:

J. B., aged eighteen years, while painting in St. Francis's Hospital, May 4, 1897, fell from a scaffolding, a distance of several feet, striking on the end of a slat eighteen inches long, two inches wide, and one-half inch thick, with two nails one and a quarter inches long driven transversely through the end (Fig. 1).

This slat entered the perineum just in front and to the left of the anus, tearing the sphincter ani muscle, the anterior wall of the rectum, and entered the bladder, producing a transverse wound of the trigone, two inches in extent, and separating the urethral from the ureteral openings. The point of the slat perforated the fundus of the bladder and entered the peritoneal cavity. The patient himself withdrew the stick, and in doing so drew out with it a piece of the omentum, which protruded from the wound about eight inches (Fig. 2).

The external perineal wound measured about two inches in length.

When found, the patient was considerably shocked. He was taken to the operating room, and immediate laparotomy was performed. Considerable urine, mixed with blood, was found in the peritoneal cavity, which was washed out with large quantities of normal salt solution. The rent in the fundus of the bladder, about one and a half inches long, was closed by three tiers of sutures,—the first two of catgut, the last of silk. The peritoneal cavity was again washed out and the abdominal wound closed without drainage.

Through the large perineal wound a drainage-tube was placed in the bladder, and the wound packed firmly with iodoform gauze. The patient returned to bed in good condition. The abdominal wound healed promptly. The patient suffered from severe iodoform poisoning, the symptoms coming on thirty hours after the operation, and rapidly subsiding after replacing the iodoform with plain gauze packing.

At a second operation, fourteen days later, the laceration of the bladder, rectum, and perineum was repaired. An examination of the perineal wound by means of retractors, separating the edges



FIG. 1.—Photograph of slit which perforated perineum, rectum, and bladder, entering finally peritoneal cavity.

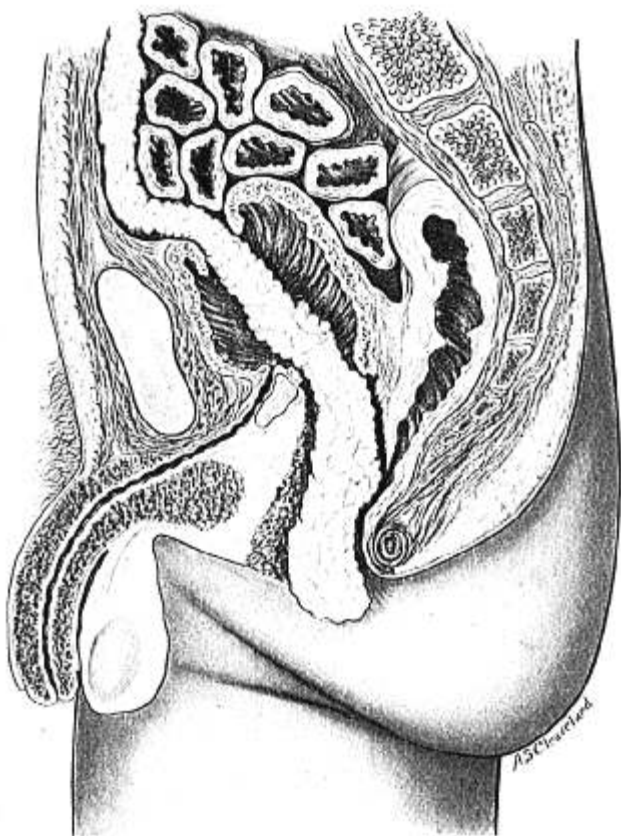


FIG. 2.—Longitudinal section of pelvis showing track of wound, with mass of omentum occupying it and protruding through perineal wound.

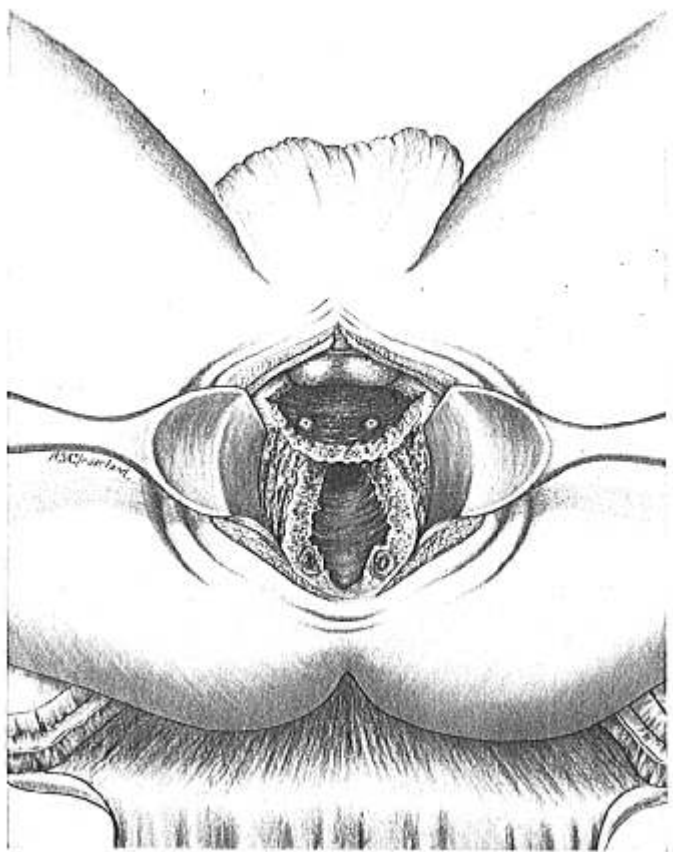


FIG. 3.—Wound in perineum dilated, exposing wounds in bladder and rectum.

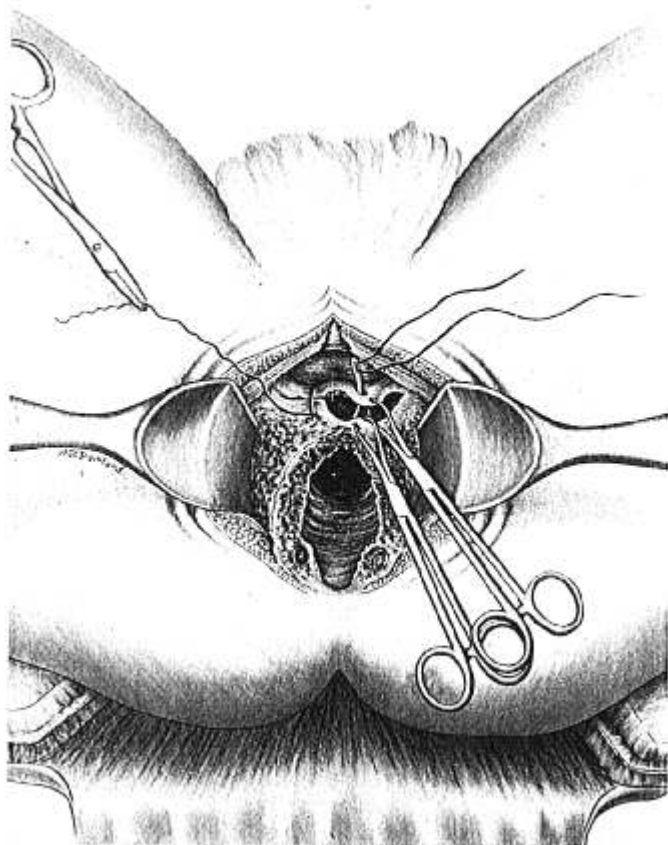


FIG. 4.—Repair of bladder wound.

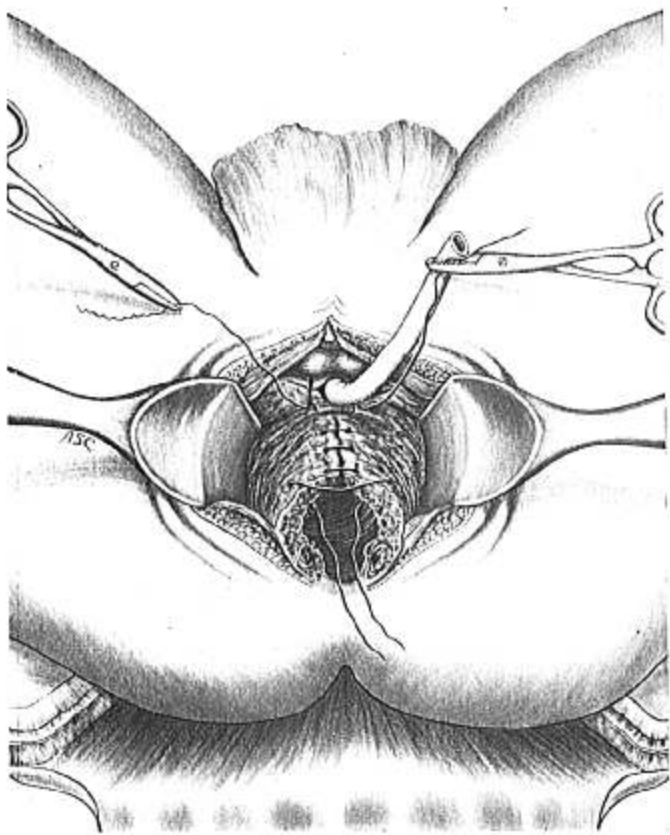


FIG. 5.—Repair of rectal wound.

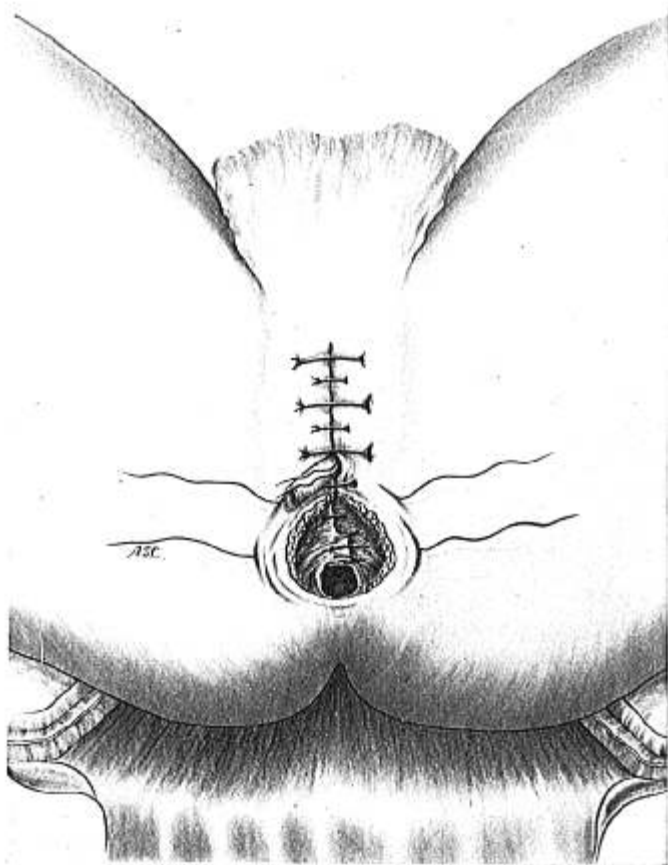


FIG. 6.—Final layer of superficial sutures closing perineal wound.

widely, showed that that portion of the trigone where the ureters enter the bladder was converted into a convex surface, on which the ureters could be plainly seen discharging their contents (Fig. 3).

The posterior edge of the wound was grasped with bullet forceps and drawn forward to the anterior edge, which was just behind the prostate, and held in position by the prostate fascia. The margins of the wound thus approximated were held in position by two silk sutures on either side of the middle line (Fig. 4). These sutures were tied, and the ends left long and brought out beside a drainage inserted into the bladder in the middle line.

The laceration of the rectum was next closed by a layer of catgut sutures tied on the mucous membrane (Fig. 5). The separated ends of the sphincter ani muscle were approximated and secured in position by silkworm-gut sutures. The superficial perineal wound was then closed as tightly as possible about the drainage-tube by catgut sutures (Fig. 6).

Recovery from the second operation was satisfactory. A vesicorectal fistula persisted for two months, which gave rise to some annoyance, but at the end of this time it was completely closed. Four months after this operation the bladder held six ounces, and the patient had to rise only once at night. One month later examination showed that the urine was normal and the patient was free from any rectal or vesical symptoms. Two years afterwards he reported that he was well and was without any functional disturbance whatever. Recently, the patient reports that his sexual and urinary functions are normal.

Remarks.—The above case presents several interesting features:

1. The circumstances surrounding the injury were most fortunate, allowing immediate laparotomy and suture of the intraperitoneal wound of the bladder.

2. The wound of the perineum, rectum, and trigone was so extensive as to necessitate surgical interference for the restoration of function. It may be noted here that this is the only case on record, so far as we have been able to discover, requiring an operation for the repair and closure of a perineal wound of the bladder.

3. The restoration of function was complete despite the severe injury to the trigone and, one would think, to the seminal vesicles and ducts.

Wounds of the bladder may be divided for convenience into (1) those presenting an external wound, and (2) those showing no external wound. The first may be subdivided into (1) puncture wounds produced by either (*a*) sharp instruments or (*b*) blunt instruments, and (2) bullet wounds; the second class includes cases of rupture. The bladder in its normal position is well shielded by the pelvic bones. These form a sufficient protection from injury by sharp or blunt-pointed instruments, except in unusual and infrequent accidents, as is shown by the experiences in the Civil War, where no injuries of this kind were reported. The bony pelvis, however, offers an insufficient barrier to penetrating wounds produced by bullets. Hence, as we would expect, the number of cases belonging to this class is very much greater, and they occur chiefly in times of war.

When the bladder has become overdilated, as the result of obstruction to the escape of urine, due either to a stricture of the urethra or, more commonly, to pathologic changes of the prostate, its walls may become stretched and much thinner than normal. Under these conditions, rupture of the bladder is not infrequent. Numerous cases of this kind are reported in the current literature. From these reports we learn that this accident often follows the most trivial injuries, such as slight falls, without any evidence whatever of external injury. The bladder, distended with foul urine, with its walls thinned by chronic overdistention, and often rendered less resistant by inflammatory changes, ulceration, etc., gives way with a slight sudden increase of pressure. The changes in the urinary tract producing conditions favorable to rupture of the bladder are not uncommon, and therefore rupture of the bladder is not a rare accident. It usually occurs in a bladder the seat of disease, the contents of which are generally infected; puncture wounds and bullet wounds, on the other hand, usually involve a normal bladder, the contents of which are sterile. This

broad distinction between the two classes of cases has much to do in explaining the relative mortality in these cases.

Historical.—Wounds of the bladder were described in the earliest times. Thus, Homer, in the *Iliad*, refers twice to this accident as rapidly fatal. The well-known aphorism of Hippocrates, “Cui persecta vesica lethale,” has been often quoted to show that wounds of the bladder were considered by the ancients to be invariably fatal, and, so far as statistics of injuries of the bladder following accidents go, this was true. It has been alleged that there were many cases of recovery from wounds of the bladder known among the early writers, but so great was the reverence for the writings of Hippocrates, that these early observers doubted the correctness of their diagnosis, and were unwilling to record observations not in accord with the teachings of Hippocrates. It is more likely that a distinction was made at an early period between traumatic injuries of the bladder and those purposely made by the surgeon, and that even the former were not regarded as invariably fatal. Aristotle distinctly states that injuries near the neck of the bladder heal, and Galen records a case of recovery from wound of the bladder, and in commenting on the aphorism of Hippocrates contended that the idea conveyed by the language used was not that these wounds were absolutely fatal, but very dangerous.

Since injuries of this kind occur most frequently in military practice, it is quite natural that the first systematic account of them should be written by a military surgeon, D. J. Larrey, published in 1817. The elaborate and extensive memoir of Larrey records his careful and accurate observations made during his extensive experience in the Napoleonic wars. It is the first attempt at a complete and systematic study of the subject, and forms the basis for the further observations by later writers.

The next most important contribution was that of Stephen Smith, “A Contribution to the Statistics of Rupture of the Bladder, with a Table of Seventy-eight Cases,” published in the *New York Journal of Medicine*, 1851. This was followed

by the reports of two Frenchmen, Demarquay, in 1851, and Houël, in 1857. In 1876 appeared the report of George A. Otis, in vol. ii, part 2, of the "Medical and Surgical History of the War of the Rebellion," containing an exhaustive summary of the records of the Civil War.

In this important work Otis analyzes and summarizes the experiences of the Civil War, and gives in the text and the footnotes numerous critical references to the early literature, which exhibits an extensive acquaintance with the whole subject. He points out that Larrey was the first to call attention to the fact that, while all accidental injuries of the bladder are very serious, those produced by shot are less dangerous than the others, and suggested that this was likely due to the nature of the wound, which was less favorable to urinary infiltration into the surrounding tissues. This same observer pointed out that the danger of bladder wounds depended in a measure on the contents of the bladder as to the degree of plenitude or vacuity at the time of the accident.

In a very important article under the title "Die Traumen der Harnblase," published in 1878, Max Bartels collected from the literature all the cases of wounds of the bladder which had been reported from the earliest times up to the date of publication of his article. These cases are divided into three groups,—puncture wounds, bullet wounds, and ruptures. A short abstract of each case is given. The statistics of each group are analyzed separately, while a general summary is presented in tabular form.

Bartels was the first and the only writer so far to collect all the reported cases scattered through the literature, for the purpose of comparison and analysis. The statistics furnished by this study are most valuable, and have been extensively quoted since by every writer on this subject.

The statistics included in this critical study may be taken to represent the results in this class of cases before the advent of modern surgery. In the great majority of cases the most that was done was to drain the bladder by a permanent catheter and cleanse the superficial wound. Operation was rarely

resorted to, and then only as symptoms developed demanding surgical interference, such as extravasation, abscess formation, etc. Just previous to the publication of Bartels's review, considerable interest in the question of operative interference in cases of wounds of the bladder was aroused by the report from America of a case of intraperitoneal rupture of the bladder successfully treated by laparotomy. This was the only case in Bartels's list of wounds of the bladder involving the peritoneum terminating in recovery, the one exception in a total of ninety-four collected cases.

Since the publication of Bartels's critical review, quite a number of cases of puncture wounds of the bladder have been recorded in the various journals, some of which are not easily accessible. These cases occurring since 1878 are particularly interesting as showing what advances surgery has made in the past three decades, and how these cases, which were formerly considered inevitably fatal, may now be saved by prompt interference.

In the English text-books of surgery very little space is given to this subject. It has therefore been considered of some practical interest and importance to give the results of the analysis of these scattered reports, which we have collected in connection with the case reported above. While we do not believe that our search of literature has been exhaustive, yet our list probably contains nearly all the cases on record since 1878, and, taken together with the list published by Bartels, forms a fairly complete record of the published cases.

In the following list the cases are arranged chronologically with reference to the date of the publication of the report, except in the last two cases. Following the name of the reporter, a short abstract of each case is given to indicate the sex and age of the patient, the nature of the instrument inflicting the wound, the point of entrance, the nature of the wound in the bladder, the treatment employed, and the result.

I. BEACH.—Boy, aged sixteen years, sitting on a window sash containing no glass. The sash gave away, and the boy fell on one of the upright pieces of the frame. Entrance through anus and rectum into the

bladder above the prostate gland. The patient pulled the piece of wood out, which was followed by copious hæmorrhage. Bladder wound admitted two fingers separated one-half inch. Treatment: retention catheter, rectal tube in bowel. Irrigation with thymol solution. Recovery in twenty-seven days.

2. BEACH (Buce's case).—Man, aged forty-six years, pushed from load of fagots and fell on a stake driven into the earth. Entrance through anus and rectum into bladder immediately behind prostate gland. Intense pelvic pain. Treatment: patient was bled and full doses of opium given. Recovery in two months.

3. *Boston Medical and Surgical Journal*, 1879.—Farmer, aged thirty-two years, while descending from hay-mow fell on a sharp cart stake fourteen inches long and two inches in diameter at base. Entrance posterior to anus, into bowel, through anterior wall of rectum into bladder just behind the prostate. Bloody urine was withdrawn with catheter. Treatment: rest and cleansing of wound, catheterized every three hours. Temperature never rose above 102° F. Recovery complete in six weeks.

4. TREVES.—Seaman, aged twenty-three years, stabbed with knife. He walked into the dispensary, but was in a condition approaching collapse from loss of blood. Entrance wound one inch long, clean cut, situated exactly in middle of left buttock. No complaint at first. Two days later symptoms of peritonitis appeared, and on fifth day after injury the patient died. Autopsy showed that the knife had taken the following course: through the gluteal muscles, divided part of great sacrosciatic ligament, passed through small sciatic notch, completely dividing the pudic artery and nerve and one vein, then entered the bladder at its lower part close to the trigone, making a wound large enough to admit tip of the forefinger.

5. STOKES.—Boy, aged sixteen years, laborer in foundry, in play was vaulting over a pair of long forger's tongs. Failed to clear the tongs and came down on the long handle, which passed into anus; symptoms of peritonitis developed immediately, and patient died seventy-four hours after injury. Autopsy: general peritonitis, subdiaphragmatic collection of pus. Double perforation of bladder; fundus perforated a little to left of median line.

6. JACKSON.—Carman, aged twenty-four years, while loading a truck slipped and fell on a "trolley," such as railway porters carry. This tore his trousers and entered the rectum. Great suprapubic pain and pain in rectum; sphincter ani paralyzed and dilated; bowel contained blood. Six ounces bloody fluid withdrawn by catheter. Rent in bladder one inch above prostate. Recovery in one month.

7. GALLER.—Young man, aged twenty-four years, stab-wound 2 centimetres long over left inguinal canal, cutting half-way through the vas deferens. Blood and urine escaped from wound. Symptoms of peritonitis developed. Retention of catheter for six days. Recovery in forty-four days. (Writer states peritoneum was opened, but there is no evi-

dence of injury of peritoneum except symptoms of transient peritonitis, so we class this as extraperitoneal.)

8. PANIZO.—Man; incised wound in hypogastric region one to two fingers above symphysis; wound 9 centimetres long, extending obliquely upward and outward. Bloody fluid from wound. Catheter in bladder felt through the wound. Wound in bladder and peritoneum each 6 centimetres long. These closed at operation by catgut interrupted sutures. Large abscess formed in wound after operation extending up to xiphoid cartilage; two litres of pus evacuated on the sixth day, followed by multiple ulcers over sacrum and trochanters; abscess reformed above symphysis. Final recovery in three months.

9. LIVON.—Man, aged forty years, house painter, stabbed with knife in hypogastrium little to left of middle line 3 centimetres above symphysis. Catheter withdrew 500 cubic centimetres bloody urine. Following injury, urine all came through wound. No symptoms of peritonitis. Retention of catheter nineteen days. Recovery in eleven weeks.

10. FIORANI.—Man, aged thirty-three years, stabbed with a knife. Entrance, right genitocrural fold. Tenesmus immediately following injury, passed small amount of bloody urine. Pains in abdomen, fulness in pelvis and dulness in hypogastric region with pain on pressure. Cystotomy performed ten hours after injury, rubber drainage-tube in incision, no suture. Drainage-tube removed in one month. Four months after injury patient left hospital, but the dulness in hypogastrium persisted. Some time later he returned to hospital, and an abscess was opened in hypogastric region. Forty grammes of pus evacuated. Eventual complete recovery.

11. HENSGEN.—Boy, aged seventeen years, on a spree, very drunk, stuck a three-cornered file into his back, which penetrated the sacrum about 10 centimetres above the anus, passing through the rectum into the bladder. After the injury the patient rode thirty-five minutes on a train and walked fifty minutes to his home with the file still sticking in his back. The wound in the bladder was in the upper part of the posterior wall. Symptoms of peritonitis present for a short time. Bloody urine. When he sat up in bed no urine escaped from the wound, but on lying down the urine was passed from this opening, and was increased by coughing, etc. Eventual recovery without operation. (Writer believes the peritoneum was injured, but the details of the case, considered in connection with other similar cases, leads us to classify this case as one of extraperitoneal wound of the bladder.)

12. BACCHIL.—Countrywoman, aged twenty-two years, fell several metres, striking on her side on a corrugated step. Piece of sharp wood entered right groin, passing upward and inward. Copious hemorrhage. Sent to hospital two days after injury. Wound 5 centimetres long, extending vertically beneath the labia into the pelvis, emitted fetid odor, and cavity contained clots of blood and ragged tissue. Tumor in pelvis soft and pasty. Catheter in bladder withdrew fluid injected into the wound. Suprapubic cystotomy. Peritoneum stripped back, exposing two vertical fissures in inferior posterior portion of bladder below the ureters; one 3 centimetres, the other 1 centimetre long. Interrupted suture of both wounds.

Drainage through wound in groin. Permanent catheter. Bladder sutures held, but there was infection of the wound carried in by the foreign body. Recovery in six weeks.

13. SOULIÉ.—Young man, aged twenty years. Knife thrust in left buttock. Wound 3 centimetres long, situated behind the superior part of the ischium at the level of the small sciatic notch. He passed some bloody urine directly after injury. Irrigations into bladder noted to pass out through the wound. Treatment: suprapubic cystotomy, bladder opened, and formal diagnosis of wound of bladder made; abdominal drainage. Recovery. Suture of bladder (?).

14. HAMILTON.—Boy, aged sixteen years, fell backward in a sitting posture, striking on a newly-cut corn stub, which entered the anus and penetrated the rectum a distance of three inches. Passed bloody urine immediately after injury. Examination: incised wound right side of anus beginning one and one-half inches external to anal margin and extending upward to a point beyond the inner boundary of the sphincter. Gas and fæces escaped involuntarily. Edges of wound could be separated one-half inch. Treatment: edges of wound brought together and sutured. Suppuration of wound occurred, urine and blood were passed through wound. Retention catheter and sedatives. Urine through the wound gradually diminished. Complete recovery in three weeks.

15. ORDIOZOLA.—Journalist, aged thirty-four years, fell on a piece of "cut cane," which entered anus. Fainted from pain. There was bleeding from the wound. Admitted to hospital two days later. Stools contained blood and urine. He assumed right lateral decubitus with legs flexed on abdomen, and presented abdominal facies; temperature, 39° C. Rectal examination: rounded wound in upper part of left lateral wall of rectal ampulla. Sphincter not lacerated, no external wound. Abdomen was tympanitic, vomiting, pulse small. Urine passed per rectum. Patient catheterized for first time on fifth day after injury, removing fetid bloody urine and blood-clots. There was a free communication between bladder and rectum. Recovery without operation in two months. (Report very fragmentary and incomplete.)

16. DELAGENIERE.—Man, aged thirty-four years, empaled on a picket, which entered perineum and perforated the bladder through and through. Entrance wound in left side of perineum 4 centimetres long, beginning behind, near the ischium, and extending forward towards the root of the scrotum. Bloody urine withdrawn with soft catheter. No symptoms of peritonitis being present on admission ten hours after injury, operation was deferred till the following morning, when peritonitis was marked. Laparotomy: intestines reddened, dark fluid—blood and urine—in peritoneal cavity. Bladder distended with clots. On posterior surface of bladder was a transverse wound 2 centimetres long. This was closed with row of catgut, copious lavage of peritoneal cavity, large quantity of sterile water left in cavity. Drain in pelvis. This was followed by suprapubic cystotomy. Clots removed, wound in trigone discovered, admitting tips of two fingers. Wound packed and incision left opened. Recovery in two months.

17. ALSBERG.—Boy, aged nine years, fell on an iron picket fence. Entrance: inner side of thigh, 10 centimetres below inguinal fold. Pierced the symphysis and produced double perforation of the bladder. Laparotomy about eighteen hours after injury, suture of wound, removal of clots of blood and fibrin. Drainage of operation wound with rubber tube. Complete recovery.

18. DODD.—Workman in royal gun factory pulling on a rope with another man; rope broke; patient fell backward with the other man on top of him, striking on a bar of iron seven-eighths inch in diameter and several feet in length, the end being bent at right angles and sticking up several inches from the floor. Entrance wound: buttock, entered the rectum two inches above the sphincter, perforated the anterior wall of the rectum, and entered the urethra through the substance of the prostate gland. Treatment: wound in buttock opened into the rectum as in operating for a fistula. Pieces of cloth removed from the depths of the wound. Permanent catheter. Bladder irrigations. Uninterrupted recovery.

19. GROSS.—Man, aged twenty-four years, fell from height of three metres and was empaled on a stick. Entered perineum, passing through the bladder into the peritoneal cavity without entering the rectum. On admission to hospital, a few hours after injury, there were no symptoms pointing to a deep wound. On the following morning peritonitis was marked. No blood or urine escaped from the wound, but a catheter withdrew 150 grammes of almost pure blood. Median laparotomy performed. Peritoneal cavity contained about two litres of urine. A wound 5 to 6 centimetres obliquely transverse near tip of fundus was closed, and a minute toilette of the peritoneal cavity performed, drainage, retention catheter; drainage of perineal wound. Patient died the following morning. Autopsy: spreading peritonitis particularly marked on right side. In right flank were found two foreign bodies overlooked at the operation, made up of pieces of skin, undershirt, and trousers.

20. WEISCHER.—Two men while mowing quarrelled, one striking the other with his scythe, inflicting a wound in the gluteal region. Scythe was removed with difficulty. Removal followed by escape of blood mixed with urine. Wound 7 centimetres long between left posterior inferior spine of ilium and the trochanter, passed inward through the foramen ischiadicum magus and penetrated the bladder. No symptoms of peritonitis. Treatment: drainage of wound with rubber tube and irrigation of the bladder. Recovery.

21. TUFFNELL.—Man was riding on a load of hay with a pitchfork sticking in the hay near him. The load was overturned, throwing the man to the ground. When picked up, he was bleeding from the bowel. No external injury. Catheter withdrew no urine. Following morning urine passed per rectum. Died in five days. Autopsy: pitchfork tine had split substance of prostate into two equal parts and penetrated the tissues behind the pubis. Intestines were matted, exhibiting the usual signs of acute peritonitis, but there was no opening into the peritoneal cavity to be found.

22. BIRKET.—Man injured by falling on a sharp stake driven into the ground, which entered the anus and pierced the rectum and bladder. There was intense pain immediately following the accident. The wound of the bladder was extraperitoneal. Recovered. (I have been unable to find the original report of this case. The incomplete notes here given are from a reference to the case made by Stokes.)

23. JAWDYNSKI.—Man, aged thirty-six years, trader. During a quarrel a knife was plunged into his right buttock. On the operating table the wound was found to be 7 centimetres from the median line, 11 centimetres from the fold of the nates, and 3 centimetres in length. A finger in the wound passed through the ischiatic foramen into the pelvic cavity as far as the rectum. The wound was 12 centimetres deep. It was widened, the gluteal artery ligated, and the wound then closed except for a gauze drain. In the evening the patient complained of inability to urinate; a catheter withdrew bloody urine. The following day the dressings were found saturated with urine. A solution of potassium iodide instilled into the bladder passed through the wound. The wound was then tamponed up to the bladder and a retention catheter used. Complete recovery in three months.

24. ROSENBAUM.—Male, aged twenty-nine years, wounded in the abdomen by a dagger. The injury was followed by sharp abdominal pain, desire to urinate but inability to void, prolapse of omentum and bowel. The patient on examination soon after the accident was found in a condition of profound shock. The wound, 6 centimetres long, was situated two fingers above Poupart's ligament, extending upward and to the left and had penetrated the abdominal cavity. There was prolapse of a piece of the omentum the size of one-half a hand and loops of the small intestine. The prolapsed omentum was ligated and excised; the bowel, being uninjured, was returned to the abdominal cavity. A silver catheter withdrew a small amount of bloody urine. The bladder was next examined through the abdominal wound. An opening into the bladder admitting the tip of the index-finger was found. The abdominal wound was enlarged to 13 centimetres and the bladder drawn up out of the pelvis. In doing so, a large quantity of extravasated urine and blood was brought up with it. The wound in the bladder, 5 to 6 centimetres long, was closed with a row of Lembert's silk sutures. The abdominal wound was closed except for a drain at the lower angle. A retention catheter was used. Except for an abscess developing in the scrotum, recovery was uneventful, and the patient discharged well in nine weeks.

The bladder may be reached by penetrating instruments in three ways: (1) through the suprapubic region, (2) the obturator foramen, and (3) the perineum. At these three points the bladder is directly exposed to injury, being unprotected by the bony pelvis. It might be supposed that, being

entirely unprotected from above, the bladder would be frequently lacerated in stab-wounds of the abdomen; that in times of war, bayonet, lance, and sabre wounds would be frequent. In the fierce hand-to-hand fighting, when bayonet charges are resorted to, it seems almost impossible that the bladder should escape. But it is a noteworthy fact that not a single case of bayonet wound of the bladder has been recorded. Indeed, stab-wounds of the bladder through the suprapubic region are not as common as we would expect. It is a curious fact that the bladder is relatively and absolutely more frequently injured by puncture wounds through the perineum. Arranged in order of frequency, we have (1) perineum, (2) hypogastrum (suprapubic), (3) obturator foramen. In the list above, there are several cases in which the entrance wound was not in either of the three regions enumerated, although they might be properly classified as subdivisions. They have, however, been separately classified as follows:

(1) Gluteal region. Five cases,—four by sharp instruments and one by a blunt instrument. Of the sharp instruments, one was a scythe and three were knives. The blunt instrument was a bar of iron (No. 18 in the list).

(2) Sacral. One case, No. 11. This is a unique case as to the location of the wound and the nature of the instrument producing it. This patient was carrying a three-cornered file in his pocket. During a drunken spree, it is supposed that he fell, wounding himself with the file in several places. Finally, he was unfortunate enough to fall in such a way as to run the file through his sacrum 10 centimetres above the anus. With the file still sticking in his back, he rode on the train for thirty-five minutes, then walked for fifty minutes more to his home. A physician was summoned, who, without apparently making a very thorough examination, left a prescription. Sometime after this visit the file was removed from the wound by a friend.

(3) Thigh. One case, No. 17. This is the only case recorded in which the protecting bony framework of the pelvis has been bored through by the penetrating instrument, and

the bladder injured. The accident resulted from a fall; the patient was empaled on an iron picket, which, after piercing the symphysis, passed completely through the bladder into the peritoneal cavity.

(4) Groin. Three cases. In two the wound was produced by a knife; in the third by a sharp stake. This latter case, the only female in the list, is interesting, as there was produced a double wound in the bladder without an involvement of the peritoneum. The stake, entering the right groin, passed obliquely upward beneath the labia, piercing the bladder in two places, making two vertical wounds, and lodged in the cellular tissue of the left pelvic space.

The entrance wounds produced by sharp instruments were thus distributed: perineum, 1; gluteal region, 4; suprapubic, 3; groin, 2. In every instance but one the injury was the result of a quarrel. In marked contrast are the wounds produced by blunt instruments. They were thus distributed: perineal, 11; gluteal, 1; sacral, 1; groin, 1; thigh, 1. It is a curious fact that such a large majority of these wounds occurred in the perineum, and in every case was the result of a fall from a greater or less height; in every case save one the rectum was also perforated. In this last case (No. 19), double perforation of the bladder was produced by a fall from a height of 3 metres, the patient being empaled on a stick, which entered the perineum and passed through the bladder without wounding the rectum.

Variety of Instruments.—Among the list of sharp instruments, the wound was made by a knife in seven cases, by a scythe in one case, by a pitchfork tine in one case, and in one case by a dagger. There is a greater variety of blunt instruments. The list includes the following: A piece of wood (stake), six cases. One case each of portion of window sash, handle of forger's tongs, "trolley," three-cornered file, stub of corn-stalk, bar of iron and lathe, and two cases of iron picket. Double perforation was produced in the last two cases.

These cases are tabulated as follows:

TABLE 1.

PUNCTURE WOUNDS OF THE BLADDER; LOCATION OF ENTRANCE WOUND;
INSTRUMENTS.

Instruments.	Perineo-anal.	Gluteal.	Abdominal.	Sacral.	Groin.	Thigh.	Total.	Died.
Sharp.....	1	4	3	2	2	10	1	..
Knife.....	..	3	2	..	2	7	1	..
Scythe.....	..	1	..	..	..	1	..	..
Pitchfork tine.....	1	..	..	..	..	1	1	..
Dagger.....	..	..	1	..	..	1	..	..
Blunt.....	11	1	..	1	1	15	1	..
Stake.....	5	..	..	..	1	6	1	..
Lathe.....	1	..	..	..	..	1	..	..
Window-sash.....	1	..	..	..	..	1	..	..
Handle of forger's tongs.....	1	..	..	..	..	1	1	..
Porter's "trolley".....	1	..	..	..	..	1	..	..
Three-cornered file.....	..	..	..	1	..	1	..	..
Corn-stalk stub.....	1	..	..	..	..	1	..	..
Iron picket.....	1	..	..	..	..	1	2	..
Bar of iron.....	..	1	..	..	..	1	..	..
Total.....	12	5	3	1	3	25	25	4

Nature of the Wounds.—Of the 25 cases, 7 were intraperitoneal and 18 extraperitoneal.

Intraperitoneal.—There were 7 cases with 2 deaths, or a mortality of 28.5 per cent. In 6 cases laparotomy with closure of the bladder wound was performed at varying intervals after the accident. Of these 6 cases, 5 recovered and 1 died, a mortality of 16.6 per cent. The cause of death in this fatal case was a violent peritonitis resulting from overlooking at the operation two foreign bodies in the peritoneal cavity composed of pieces of skin, undershirt, and trousers, which had been carried in by the penetrating instrument (Case 19). One case not operated upon terminated fatally seventy-four hours after injury. Barring the oversight in the case referred to, the mortality in cases operated upon should be *nil*, while the mortality in cases of intraperitoneal wounds of the bladder not operated upon was 100 per cent. This agrees with Bartels's statistics. In ninety-four cases of wounds of the bladder from all causes involving the peritoneum, ninety-three ended fatally,—the one case of recovery was the only case operated upon. In the ten cases of puncture wounds of the bladder in which the peritoneum was injured the mortality was 100 per cent. It may be remarked here that a comparison of the

statistics of these two groups of cases emphasizes the value of operative interference in these cases, and illustrates what surgery has accomplished in this class of injuries.

Extraperitoneal.—Among the cases classified as extraperitoneal are several with symptoms of peritonitis, and for this reason they were reported as cases of intraperitoneal wounds. But in every case the peritonitis was localized and transient, and it seems improbable that the peritoneum was injured in any of these cases. We know, furthermore, from autopsy findings, that symptoms of peritonitis may be marked in certain cases of wound of the bladder, without, however, showing any injury of the peritoneum.

Of the 18 cases, 2 died, a mortality of 11.1 per cent. Neither of these 2 cases was operated upon. Two of the 18 cases were operated upon, and both recovered. The cause of death in the two fatal cases was extravasation of urine with diffuse suppuration (Nos. 4 and 21). In the last case (No. 21), symptoms of peritonitis were marked, although at autopsy it was found that the peritoneum had not been injured.

TABLE II.
GENERAL SUMMARY.

No.	Died.	Mortality.	INTRAPERITONEAL.				EXTRAPERITONEAL.			
			No.	Died.	Mortality.	Operated on.	Mortality.	No.	Died.	Mortality.
25	4	16 per cent.	7	2	28.5 per cent.	6	16.6 per cent.	18	2	11.1 per cent.
								2		0 per cent.

Double Perforation of the Bladder with Injury of the Peritoneum.—Of all injuries of the bladder, puncture wounds which perforate this viscus in two places and produce a laceration of the peritoneum are the most infrequent. This is an exceptionally rare accident. Only two cases are recorded in Bartels's list of fifty cases of puncture wounds. Four additional cases have been collected, and are included in the above

list of intraperitoneal wounds, while the case here reported makes seven cases in all.

The two cases collected by Bartels are as follows:

1. A soldier in a drunken quarrel was stabbed by a fellow soldier with a "Danish Hohlklinge," which entered the hypogastrium just above the symphysis and a little to the left of the middle line, passing through the peritoneal cavity, the ileum, and the bladder, passing out behind near the coccyx. The wounds were small. Prolapse of the injured bowel. Patient lived twenty-one days.

2. Man, aged forty-three years, fell on the leg of a chair. Entrance through the anus into the bladder. Great pain in the bladder region and pelvis. Collapse. Catheter withdrew bloody urine. Beginning peritonitis. Died in twenty-one hours. Autopsy: rectum and neck of bladder pierced; a second wound of the fundus communicated with the peritoneal cavity. Bloody fluid found in the latter.

The four cases reported in the literature since 1878 are abstracted in the list above, Nos. 5, 16, 17, and 19. In only one case was the wound made by a sharp instrument, No. 1 above, collected by Bartels. The accident resulted from a quarrel.

In six cases the injury resulted from a fall on a blunt instrument, as follows: chair leg, 1; iron picket, 2; handle of forger's tongs, 1; lathe, 1, and stick, 1. In five of these cases the entrance wound was in the perineum. In the sixth case an iron picket entered the inner side of the thigh 10 centimetres below the inguinal fold. In all but one case in which the point of entrance was in the perineum the rectum was perforated and a vesicorectal fistula persisted for a considerable time. In no case was the fistula permanent, and in no case was a separate operation for its closure necessary.

Of these seven cases of double perforation, three were fatal,—one in twenty-one days, one in twenty-one hours, and the third in about thirty hours, a mortality of 42.8 per cent. It is to be noted, however, that the 42.8 per cent. represents the total mortality, including the cases which were operated upon and those which were not. If we analyze the cases farther, we find that in three cases no operation was performed, and all ended fatally, giving a mortality of 100 per cent. In the four

cases subjected to laparotomy and suture of the bladder wound and peritoneum three cases were saved, thus giving a mortality of 25 per cent. This fatal case died from peritonitis resulting from a foreign body introduced into the peritoneal cavity at the time of the accident and overlooked at the operation, as noted above. These statistics again strongly emphasize the value of immediate operation in intraperitoneal wounds of the bladder.

TABLE III.

CASES OF DOUBLE INTRAPERITONEAL PERFORATION OF THE BLADDER, SHOWING THE KIND OF INSTRUMENT, LOCATION OF ENTRANCE WOUND, OPERATION, AND RESULTS.

Instruments.	Perineum.	Suprapubic.	Through Symphysis.	No.	Died.	Mortality.	No. operated on.	Died.	Mortality
Sharp .....	..	..	..	7	3	42.8 per cent.	4	1	25 per cent.
"Danish Hohlklänge" .....	..	..	..	..	..	..	..	..	..
Blunt .....	..	..	..	..	..	..	..	..	..
Chair leg	1	..	..	..	..	..	..	..	..
Iron picket	1	..	1	..	..	..	..	..	..
Lathe	1	..	..	..	..	..	..	..	..
Handle of tongs	1	..	..	..	..	..	..	..	..
Stick	1	..	..	..	..	..	..	..	..

A brief summary of Bartels's cases may be given for the sake of comparison, and, taken together with the above, gives fairly complete statistics for punctured and lacerated wounds of the bladder.

Bartels collected 504 cases of injury of the bladder, classified as follows: punctured wounds, 50 cases; bullet wounds, 285 cases, and rupture, 169 cases. Death resulted in 228 cases, or a mortality of 45 per cent. Of the 504 cases, 131 were intraperitoneal and 373 were extraperitoneal.

Every case of intraperitoneal wound terminated fatally except one, the case of rupture, reported by Walther, of Pittsburg, in which recovery followed laparotomy, cleansing of the peritoneal cavity, and the use of a retention catheter, without, however, suture of the wound in the bladder. The mortality was, therefore, 99.2 per cent. Of the 373 cases of extraperitoneal wounds, 85 terminated fatally, a mortality of 22 per

cent. If we analyze these cases farther, we find the per cent. of mortality varied greatly with the nature of the injury; thus for puncture wounds it was 2.5 per cent.; bullet wounds, 15 per cent.; and for ruptures, 61 per cent. These results are given in the following table, slightly modified, from Bartels.

TABLE IV.
INJURIES OF THE BLADDER.

Injury	Total.	Death.	Mortality.	Intraperitoneal.			Extraperitoneal.			Rectum Injury.	Bone Injury.
				Total.	Death.	Mortality.	Total.	Death.	Mortality.		
Puncture...	50	11	22 percent.	10	10	100 per cent.	40	1	2.5 per cent.	13	...
Bullet.....	285	65	22.8 percent.	27	27	100 per cent.	258	38	15 per cent.	60	131
Rupture.....	169	152	90 percent.	94	93	99 per cent.	75	46	61 per cent.	1	65

Of the 50 cases of puncture wounds, 20 were produced by blunt and 26 by sharp instruments, while the remaining 4 were gored by animals,—3 by steers and 1 by a bison. In 22 cases the entrance wound was in the perineum; 5 were produced by sharp and 17 by blunt instruments. Of these 5 cases, 3 recovered, and 2 died from peritoneal injury.

In the 17 cases in which the injury was due to a blunt instrument, this entered the anus in 13 cases, and the rectum was perforated in every case. In 4 cases the wound entered the perineum, reaching the bladder without wounding the bowel. Three of the 13 cases ended fatally; in two of these there was definite involvement of the peritoneum, while in the third the symptoms strongly pointed to that complication.

These cases are tabulated by Bartels as follows:

The combined statistics then include 75 cases of puncture wounds of the bladder; 15 of these were fatal, a mortality of 20 per cent. The most striking feature of these two groups of cases is the great difference in the per cent. of mortality in the intraperitoneal wounds. In Bartels's series this is 100 per cent., while in the 25 cases which we have collected it is 28.5 per cent. This marked diminution in the per cent. of fatal

cases is explained by the fact that operative interference was more frequently resorted to, and a relatively large number of cases were saved.

TABLE V.

TABLE OF PUNCTURE WOUNDS OF THE BLADDER.—BARTELS.

Instruments.	Regio Perineo-anal.		Obturator for-anal.		Abdominal.		Not stated.		Healed.		Died.		Not stated.		Summary.	
A. Sharp-pointed weapons.....	5	..	1	..	19	..	2	..	19	..	8	..	..	..	27	..
Lances.....	..	..	1	..	1	..	1	..	2	..	..	..	..	..	..	2
Daggers.....	2	..	..	..	4	..	2	..	2	..	4	..	..	..	..	8
Knives.....	1	..	..	..	8	..	..	..	1	..	1	..	..	..	..	9
Pitchfork.....	..	..	..	..	1	..	..	..	1	..	..	..	..	..	..	1
Not stated.....	2	..	..	..	5	..	..	..	3	..	3	..	..	..	..	7
B. Blunt-pointed....	17	..	..	..	1	..	2	..	16	..	3	..	1	..	20	..
Pitchfork handle.....	2	..	..	..	..	..	1	..	2	..	1	..	..	..	3	..
Chair leg.....	2	..	..	..	1	..	..	..	2	..	1	..	..	..	3	..
Stick—broom-handle.....	11	..	..	..	..	..	1	..	10	..	1	..	1	..	12	..
Hot iron.....	1	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..
Lead-pencil.....	1	..	..	..	..	..	..	..	1	..	..	..	..	..	1	..
C. Animals' horns..	..	..	..	..	..	..	3	..	3	..	..	..	..	..	3	..
Steer.....	..	..	..	..	..	..	2	..	2	..	..	..	..	..	2	..
Bison.....	..	..	..	..	..	..	1	..	1	..	..	..	..	..	1	..
Total.....	22	22	1	1	20	20	7	7	38	38	11	11	1	1	50	50

Diagnosis.—The diagnosis of injury of the bladder in penetrating wounds of the lower abdomen and perineum is rarely difficult. The escape from the wound of blood *mixed with urine* leaves no doubt that the bladder has been entered. In the majority of cases this sign has been present. The withdrawal of bloody urine by means of the catheter is an equally positive indication that the bladder has been injured. This examination should never be neglected whenever there is a question as to whether or not the bladder has been punctured, and it should be made early. In the case of a wound made by a small sharp instrument, it may be so small as to become effectually closed by a blood-clot, and thus prevent the escape of urine. We may not suspect its depth, unless we catheterize the patient and withdraw urine mixed with blood; and just this class of wounds are the most important, since we are more apt to overlook the gravity of the condition until the extravasa-

tion of urine into the peritoneal cavity or into the perivesical tissues warns us that what we considered so trivial is in fact a serious accident. Mistakes of this kind have happened, and the consequences in some cases have been serious.

After it has been definitely determined that the bladder has been wounded, there still remains the more important question of whether or not the peritoneal cavity has been opened. This is by no means so easily determined, and yet an early diagnosis is of the utmost importance, as the success or failure of an operation may depend upon the time which has elapsed since the receipt of the injury,—the longer this interval the smaller the chances of recovery. Too often in the cases reported this accident has been recognized only after the symptoms of peritonitis have become well defined, or, indeed, in some cases only at autopsy was the true nature of the injury discovered.

In those cases where, following an injury of the bladder, there is prolapse of the omentum, as in the case here reported, or of the bowel, as in one of the collected cases, there can be no doubt as to the peritoneal involvement and the necessity for prompt interference to save the patient's life. Such cases are, however, exceedingly rare. In the majority of cases where doubt exists a positive diagnosis can be made only by an exploratory incision and a careful inspection of that portion of the bladder covered by peritoneum; and such examination should not be delayed. We know that, in rupture of the healthy bladder and extravasation of its contents into the peritoneal cavity, the urine may lie in contact with the peritoneum for many hours without giving rise to symptoms of peritonitis. In puncture wounds involving the peritoneum, however, the danger of infection, carried in by the foreign body, is increased many fold. Symptoms of peritonitis, therefore, are likely to make their appearance much earlier, and are usually much more violent. Hence the necessity for an early diagnosis becomes imperative.

It might be thought *a priori* that the position of the entrance wound would be significant; that the peritoneum is

more likely to be injured when the instrument reaches the bladder through the hypogastrium. This is not borne out, however, by the statistics. Of the ten cases of intraperitoneal wounds in Bartels's list, in at least 50 per cent. the entrance wound was in the perineal and sacral regions, while in our list of seven cases there is only one case in which the entrance wound was in the hypogastrium.

Following a laceration of the bladder, if a catheter withdraws only a few cubic centimetres of bloody urine even with repeated catheterizations, and no considerable amount of urine is escaping from the wound, we may strongly suspect that the peritoneum has been wounded, and that extravasation is taking place into the abdominal cavity. Under such circumstances, exploratory laparotomy should be performed at once. In every case of wound of the bladder, when positive signs are absent enabling us to settle the question of peritoneal laceration, we are justified in following the dictum, "When in doubt, explore."

Treatment.—The treatment to be employed will depend naturally upon the nature of the wound, *i.e.*, whether it is extraperitoneal or intraperitoneal, or a combination of the two, as in certain cases of double perforation. In extraperitoneal wounds the chief danger to the patient is extravasation; and hence it is against this complication that whatever measures are taken should be directed. The seriousness of this accident is greatly intensified by the fact that the tissues along the track of the wound have been almost invariably infected, and hence rapid and extensive suppuration and destruction of tissue supervene. The essential point in the treatment of these cases is *free drainage*. When the wound is large and permits the free escape of urine from the bladder, there is little danger of this complication. Such a case will generally heal promptly with the usual cleansing and care of the wound and a retention catheter for a few days, or, where this is not well borne, regular emptying of the bladder every three hours by means of the catheter. In a few days the urine will begin to be

voided naturally in increasing amounts, while the escape of urine through the wound will gradually diminish, and finally cease altogether in a relatively short time, and the wound rapidly granulate. In no case has it been found necessary to close the opening in the bladder by operation.

If the track produced by the instrument be small and the escape of urine is insignificant, the wound should be opened up freely by incision, cleansed out thoroughly, and free drainage of the bladder established. Where the wound is so situated that it is impossible or inadvisable to enlarge it sufficiently to allow the free escape of urine, perineal section should be performed at once. This gives perfect drainage of the bladder, thus avoiding the possibility, and even almost certain probability, of extravasation with all its dangerous sequelæ. The puncture wound, thus put into a condition of rest, will granulate rapidly, after which the urethrotomy wound will close readily. Another advantage of this procedure is that it permits a thorough exploration of the wound and the bladder for foreign bodies—pieces of clothing, etc.—which may have been carried in, and which, if not removed, may form the nucleus for the development of a stone, and, later, an operation will be required for its removal. This complication is by no means rare.

Intraperitoneal Wounds.—A wound of the bladder communicating with the peritoneal cavity is a positive and urgent indication for (1) immediate laparotomy and exposure of the rent in the peritoneum and bladder; (2) closure of the wound by sutures; and (3) removal of the urine, blood, and foreign bodies, if present, from the peritoneal cavity. The details in carrying out this line of treatment will vary with the individual operator, but there is at present among surgeons a very general agreement as to the main points in the treatment as outlined above.*

* It is a curious fact that the idea of suturing wounds of hollow viscera was so tardily taken up by surgeons and put into general practice. This was due undoubtedly to the fact that in the preantiseptic period the open-

The obvious advantages of this procedure are:

(1) It permits a careful inspection of the bladder and an examination of the peritoneal cavity for extravasation of

ing of the abdominal cavity was followed by a frightfully high mortality. The dangers of abdominal section were so great as to deter the boldest from performing this operation for the purpose of the proper repair of laceration of the intra-abdominal organs. In the case of intraperitoneal wounds of the bladder, Sir Benjamin Bell is generally given the credit of having been the first to advise suture of the wound as early as 1789. According to Vincent, Jacob Woyt advised the closing of bladder wounds by sutures long before the time of Bell—as early as 1716. However this may be, it is pretty certain that this procedure was first carried out in man by Willet, "Abdominal Section in a Case of Ruptured Bladder," *St. Bartholomew's Hospital Reports*, 1876, vol. xii, p. 209. Willet's case was operated on thirty-six hours after injury. Symptoms of peritonitis were present. Furthermore, the continuous suture which was used slipped. This patient died. The second case, operated on by Heath forty hours after injury, also ended fatally. In this case, also, the suturing was faulty, and extravasation of urine and blood into the peritoneal cavity continued after the operation. This case of Heath precipitated a long discussion before the Royal Medical and Chirurgical Society of London as to the methods of treatment which should be adopted in these cases. There was little unanimity of opinion among the surgeons as to the proper course to be followed. Willet was severely criticised by his confrères for the method which he employed, but he stoutly defended his views, and expressed the opinion that the operation as carried out by him, if performed in time, was the only rational treatment to be employed. Holmes held the same view. Finally, Morris seems to have ended the controversy by declaring in favor of Willet's view as follows: If the wound is intraperitoneal, employ the method of Willet, that is, immediate laparotomy and suture; if extraperitoneal, cystotomy suffices.

Vincent, in an article in *Revue de Chir.*, 1881, gives the result of some important experiments undertaken by him for the purpose of determining the value of immediate suture in intraperitoneal wounds of the bladder. These include puncture wounds, single and double; lacerations; double perforations with bullets; and resections of portions of the bladder. In these experimental cases the wounds were closed by interrupted suture at varying intervals after the injury. From these experiments he concluded that *immediate* operation is essential; the wound of the bladder should be closed by interrupted sutures. In every case where the operation was done early, good results were obtained.

Vincent, calling attention to the fact that Walther, of Pittsburg, was the first and only one who had saved a patient with intraperitoneal wound of the bladder, continued: "His example must be followed with greater confidence since we possess to-day the antiseptic methods of Lister.

blood and urine, foreign bodies, and injuries to the intestines.

(2) The wound in the bladder can be tightly closed by sutures, thus preventing the further escape of urine into the abdominal cavity,—in other words, to remove the cause of the mischief. Extravasated urine and blood-clots can also be removed, and a thorough abdominal toilet performed. Injuries to the viscera, when present, may be repaired, thus avoiding the dangers of serious and even fatal complications from this source.

The rent in the bladder and peritoneal covering having been exposed, it should be closed by a row of interrupted sutures. Fine silk is the best material to use. A continuous suture should not be used, as there is danger of its slipping, and the closure is not so perfect. This accident happened in the first two cases in which suture of a bladder wound was employed. A careful toilet of the abdominal cavity should be made, removing the urine and blood, and a thorough search made for foreign bodies. It is safer to drain the abdominal wound for a few days by means of a small gauze wick. A retention catheter should be worn for a few days. This removes the urine promptly, avoids distention of the bladder and pressure on the sutures, and allows the healing of the wound to progress rapidly. In cases of double perforation, where the second wound is extraperitoneal, this should be thoroughly cleansed and lightly packed with gauze.

The statistics for intraperitoneal puncture wounds of the bladder are far from satisfactory, but they are improving, as shown by the tables above. With prompt intervention, the majority of these cases which were formerly invariably fatal should be saved. The same statement is also true of intraperitoneal rupture of the bladder. In a recent article of Seldowitsch, thirty-nine cases of recovery after intraperitoneal rup-

Under the leadership of Lister, this method has introduced a new era into surgery in general; the surgery of the bladder must not be excluded from its benefits."

ture of the bladder, collected from various sources, are reported.

It is only by promptness and thoroughness in our treatment that we can hope that in the future a larger number of these desperate cases will be saved.

Since completing the above tabulation, two additional cases have been found and may be added here.

1. DOUGLAS, in the *Southern Practitioner*, Nashville, 1894, vi, 13, in a paper on the recognition and management of wounds of the urinary bladder, reports the following case of extraperitoneal wound of the bladder.

A boy, aged thirteen years, was seated in an open vehicle; a horse attached to a buggy ran into him from the rear. In the collision he was thrown forward, the shaft of the buggy striking him just to the right of the coccyx. He was rendered insensible. The first complaint was of hypogastric pain and an urgent desire to urinate. Examination under an anæsthetic revealed an irregular circular wound just to the right of the coccyx near the anal margin. The shaft had entered at this point, lacerating the fibres of the sphincter, pushing aside the rectum, and penetrated the base of the bladder. Digital examination showed that the bladder was otherwise intact. The wound was packed with gauze. On the third day there was abdominal tenderness and tympany with a temperature of 102° F. These symptoms gradually disappeared. Healing was rapid, the patient being discharged well in five weeks.

2. In the *St. Petersburg Med. Wochen.*, 1903, No. 17, p. 29, occurs a brief abstract of a case reported by ARONSTAMM in the *Woenno Meditsinski Shurnal*, November-December, 1902, under the title, "Ein Fremdkörper der Harnblase der durch eine Wunde der Blasenwand eingebracht ist."

The abstract reads as follows: A blade of straw was carried into the bladder by an injury with a pitchfork. By the contraction of the bladder, the straw stuck into the bladder walls, causing marked irritation, frequent urination, and cloudy urine. One end of the straw protruded into the urethral opening. By gentle massage the straw was gradually removed per urethram. The wound in the bladder healed without direct surgical intervention.

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The above list contains the most important articles. No attempt has been made to give a complete bibliography. References to the cases collected are given in the last table.

SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER.

No.	Reporters.	Sex.	Age.	Instrument.	Entrance Wound.	Prominent Symptoms.	Perforation.	Operation.	Result.	Remarks.
1	Beach. Boston Med. and Surg. Jour., 1879. c. 878.....	M.	16.	Portion of window sash.	Anus, rectum.	Hæmorrhage.	Extraperitoneal.	None.	Recovery in 27 days.	Laceration of bladder just above prostate admitted two fingers spread apart half inch.
2	Quoted by Beach. Patient of Hunt Slough, Boston Med. and Surg. Jour., 1879. c. 878.....	M.	46.	Stake driven in to earth.	Anus, rectum.	Intense pain.	Extraperitoneal.	None.	Recovery in 2 months.	Laceration in bladder immediately behind prostate.
3	Boston Med. and Surg. Jour., 1879. ci, 738....	M.	32.	Cart stake, 14 in. long, 2 in. diam. at base.	Posterior to anus, rectum.	.....	Extraperitoneal.	None.	Recovery in 6 weeks.	Bladder wound near neck.
4	Treves. Med. Times and Gazette, 1879.....	M.	23.	Sailor's knife.	Left buttock. Lesser sacroscopic notch.	No symptoms first 12 hours. Vomiting. Abdominal pain. Acute peritonitis.	Extraperitoneal.	None.	Died in 5 days.	Extravasation of urine. Peritonitis. No bladder symptoms.
5	Stokes. Trans. Acad. Med. Ireland, Dublin, 1883, i, 88-94.....	M.	16.	Handle of forger's tong s.	Anus and rectum.	Bloody urine. Peritonitis.	Double: Extraperitoneal. Intraperitoneal.	None.	Death in 74 hours after injury.	Pierced trigone, and perforation of fundus of bladder to left of median line.
6	Jackson. Lancet, 1883, i, 231.....	M.	24.	Trolley such as railroad porters carry. Fall.	Rectum.	Suprapubic pain. Pain in rectum. Bloody urine.	Extraperitoneal.	None.	Recovery in 28 days.	Rent in bladder, 1 inch above prostate. Sphincter ani paralyzed and dilated.
7	Galler. Aertzl. Int. Bl. München, 1884, xxxi, 123.....	M.	24.	Knife. Sub-wound in lower abdomen.	Left inguinal canal.	Blood and urine from wound. Peritonitis.	Extraperitoneal. Intraperitoneal.	None.	Recovery.	Retention of catheter. Galler thinks wound intraperitoneal, but history not conclusive. Probably extraperitoneal.
8	Panizo. Rev. Med. de Sevilla, 1886, ix, 97....	M.	(?).	Incised wound.	Hypogastrium, two fingers above symphysis.	Bloody fluid from wound. Local peritonitis.	Intraperitoneal.	Cystostomy. Suture of bladder and peritonium with interrupted catgut.	Recovery in 3 months.	Large abscess formed about site of wound. Wound in peritonium 6 centimetres long.

9	Livon. Marseille Med., 1886, xxiii, 706.....	M.	40.	Knife. Stab-wound.	Little to left median line, 3 cm. above pubis.	Hæmaturia through wound.	Extraperitoneal.	None.	Recovery in 12 weeks.	.....
10	Fiorani. R. ist. Romb. di Med. 1888, 2-3, xxi, 700.....	M.	33.	Knife stab.	Right genito-crural fold.	Bloody urine; tenesmus; sense of fullness in pelvis, local peritonitis.	Extraperitoneal.	Suprapubic cystotomy (?).	Recovery.	Abscess formed in hypogastrium after healing of operative wound. Complete recovery in about four months.
11	Hensgen. Deutsche Med. Woch., 1893, xix, 592.....	M.	17.	Three-cornered file. Fall.	Through sacrum 10 cm. above anus.	Localized peritonitis. Bloody urine.	Extraperitoneal. Intraperitoneal (?).	None.	Recovery.	Local peritonitis supposed to be due to an abdominal wound, &c., file entered above peritoneal reflection.
12	Bacchi. Gazz. Med. Cremonese, Cremona, 1894, xiv, 2-5.....	F.	22.	Piece of wood from a fall.	Right groin.	Hæmorrhage from wound. Tumor in pelvis. Bloody urine.	Extraperitoneal (?).	Suprapubic cystotomy, closure of two wounds by interrupted sutures.	Recovery in 6 weeks.	Phlegmon resulting from infection at time of accident.
13	Soulié. Marseille Med., 1895, xxiii, 164-9.....	M.	20.	Knife thrust entering buttock.	Small sciatic notch.	Hæmaturia.	Extraperitoneal.	Suprapubic cystotomy.	Recovery.	.....
14	Hamilton. Indiana Med. Jour., 1895-6, xiv, 229.....	M.	16.	Corn-stalk sub. Fall.	Anus and rectum.	Involuntary stools. Bloody urine.	Extraperitoneal.	Edges of wound sutured.	Recovery in 2 to 3 weeks.	External wound: $1\frac{1}{2}$ inches, extending to anal margin. Laceration of sphincter.
15	Monitor Med., Lima, 1896, xi, 54-56. Odhonzala.....	M.	34.	Fell on a piece of cut cane.	Anus and rectum, no external wound.	Liquid stools with blood and urine. Abdominal fascies.	Extraperitoneal.	None.	Recovery in 2 months.	Vesicorectal fistula. Cellulitis in left iliac fossa.
16	Delageniere. Arch. Prov. de Chir., Fat., 1898, vii, 240.....	M.	34.	Picket in fence. Fall.	Perineum left side, 4 cm. long from behind towards root of scrotum.	Bloody urine. Shock.	Double: Extraperitoneal. Intraperitoneal.	Following morning, laparotomy; suprapubic cystotomy.	Recovery in 2 months.	.....
17	Alaberg. Münch. Med. Woch., 1898, xiv, 79.	M.	9.	Iron picket.	Inner side of thigh, 10 cm. below inguinal fold.	.....	Double: Extraperitoneal. Intraperitoneal.	Laparotomy 18 hours after injury.	Recovery in 20 days.	Case unique.
18	Dodd. Brit. Med. Jour., Feb. 24, 1900.....	M.	Adult.	Bar of iron. Fall backward.	"Buttock," 2 in. above anus.	Bloody urine.	Extraperitoneal.	None.	Recovery.	Pieces of clothing in wound.
19	Gross. Rev. Med. d. Est. 1904, xxxiii, 497.	M.	24.	Stake. Fall, height 3 metres.	Perineum. Rectum not entered.	Absence of symptoms till onset of peritonitis.	Double: Extraperitoneal. Intraperitoneal.	Median laparotomy.	Death.	Foreign bodies carried into abdominal cavity set up peritonitis. These overlooked at operation.

SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER.—CONCLUDED.

No.	Reporters.	Sex.	Age.	Instrument.	Entrance Wound.	Prominent Symptoms.	Perforation.	Operation.	Result.	Remarks.
20	Weischer. Cent. f. Chir., 1902, xxviii, 127.	M.	Adult.	Scythe, struck by companion in quarrel.	Gluteal region. Foramen ischiadicum magus.	Blood and urine from wound.	Extraperitoneal.	None.	Recovery.	Wound 7 cm. long between left posterior iliac spine, ilium, and trochanter. Drainage with rubber tube.
21	Tuffnell. Proc. Path. Soc., Dublin, vol. 19, 312.	M.	20.	Pitchfork tine. Fall.	Anus and rectum.	Bleeding from bowels. All urine passed per rectum after injury.	Extraperitoneal.	None.	Died in 5 days.	Autopsy: Extravasation of urine. Prostate split into two equal parts. Perineum not injured. Local peritonitis.
22	Biket. Holmes' Surgery.	M.	.....	Sharp stake driven into ground.	Anus and rectum.	Intense pain.	Extraperitoneal.	.....	Recovery.	Quoted by Stokes.
23	Jawdyski. Gaz. lek., Warszawa, 1890, 2, 5, x, 626-653.	M.	36.	Knife stab in a quarrel.	Right buttock.	Hemorrhage from the wound. Retention of urine.	Extraperitoneal.	Ligation of artery. Partial closure of wound. Drainage.	Recovery in 3 months.	No complications. Wound healed by granulation.
24	Rosenbaum. Protok. Med. Oshansk., Tiflis, 1890-91, xxvii, 353-364.	M.	29.	Dagger wound.	Left inguinal two fingers above Poupert's ligament.	Prolapse of bowel. Collapse. Bloody urine by catheter.	Intraperitoneal.	Suture of bladder.	Recovery in 2 months.	Prolapse of omentum and bowel. Excision of portion of omentum. Abscess complication.
25	Evans.	M.	18.	Fell on slat.	Anus and rectum.	Shock.	Double: Intraperitoneal; Extraperitoneal.	Laparotomy. Repair of perineum.	Recovery in 2 months.	Omentum protruding from perineal wound. Immediate laparotomy, suture of bladder, and later repair of perineum.